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UNITED STATES DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

SUMMARY REVIEW OF MONTHLY REPORTS¹
FOR
SOIL CONSERVATION SERVICE--RESEARCH²
OCTOBER 1951

EROSION CONTROL PRACTICES DIVISION

Cotton and Corn Yields - B. H. Hendrickson, Watkinsville, Ga.

"Cotton yields in 1951 were the best in the history of the Station. Even the cotton grown continuously on the same land for 9 years, in 1951 produced from 50-75 percent more than the previous 8-year average (1943-50). These comparisons are shown in table 1.

Table 1.--Seed cotton yields on three land classes

	Land Class II	Land Class III	Land Class IV
	8" topsoil	5" topsoil	no topsoil
	Lbs/ac.	Lbs/ac.	Lbs/ac.
(1951 yield	1,676	1,286	516
Continuous (Previous 8-yr.			
cotton (average (1943-50)	968	840	346
(1951 increase	708	446	170

"Cotton-yield increases in the rotations were even more striking. The 1951 cotton yield, compared with the previous 8-year average for one 3-year rotation is shown in table 2.

Table 2.--Seed cotton yields on three land classes when cotton was grown in a conservation-type rotation

3-year rotation No. 18	Land classes		
	II	III	IV
	8" topsoil	5" topsoil	2" topsoil
	Lbs/ac.	Lbs/ac.	Lbs/ac.
(1951 yield	2,718	1,998	1,145
(1) Oats (seed) Kobe lesp.(seed)			
(Previous 8-yr.			
(2) Cotton-vetch (green manure) (av. (1943-50)	1,150	941	752
(3) Corn (1951 increase	1,568	1,057	393

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²All research work of the Soil Conservation Service is in cooperation with the various State Experiment Stations.

NOTE--In the Summary Review of Monthly Reports for September 1951 on p. 2 the item on Legume Studies should have been credited to C. J. Whitfield, Amarillo, Tex., rather than to N. P. Swanson who is project supervisor of the irrigation studies at Amarillo.

"Of all of our rotations containing cotton, the best cotton yield of 2,718 lbs/acre seed cotton on Class II land was produced by a 3-year rotation of (1) Oats (seed)-Kobe lespedeza (seed), (2) Cotton-vetch, and (3) corn. This yield was 1,042 lbs/acre of seed cotton better than continuous cotton produced on the same Class II land with the same rate of fertilization for the cotton crop. This particular rotation, well adapted for use on Class II land, is not considered to supply sufficient ground cover protection for Class III land. The best cotton yield on Class III land was 2,357 lbs/acre seed cotton, and was produced by a more protective perennial grass-based 4-year rotation: (1) oats (seed)-Ky 31 Fescue / Ladino clover (hay), (2) Fescue / Ladino (hay), (3) Fescue / Ladino (hay), and (4) Cotton.

"The highest corn yield in 1951 on the Station was 63.5 bushels per acre on Class III land. This was produced by a 3-year rotation: (1) Oats (seed)-Ky 31 Fescue / Biennial White Sweet clover, (2) Fescue / Sweet clover (hay), and (3) Corn.

"The 1951 growing season was much more favorable for cotton than for corn production. But for both crops grown on Class III land, which needs both protection against erosion and soil improvement, the grass-legume sods when turned under in rotation practices were followed by the top yields of both cotton and corn, in 1951."

Dairy Production Increase - H. O. Anderson, La Crosse, Wisc.

"Dairy production increased about 50 percent over a period of 10-12 years on eight farms in the Chimney Rock Area on which soil conserving programs were started in the late 1930's. During the same period, the increase in milk production in the State as a whole was about 33 percent. Soil conservation plans for these farms were developed by these farmers in cooperation with Soil Conservation Service personnel of the Chimney Rock Soil Conservation District office which was located at Independence from 1935 to 1940.

"Not only did the increase in quantity and quality of hay and pasture provide feed for larger dairy herds, but also provided more liberal rations for the dairy cows. On the average, about two cows and two dairy heifers were added to the herd during this period and butterfat production increased from about 200 pounds per cow to about 275 pounds."

Grain Sorghum Yields - C. J. Whitfield, Amarillo, Tex.

"Grain sorghum yields on the station this year were above average. The continuous sorghum plots made an average yield of 20.7 bushels per acre. These plots have been cropped continuously to sorghum for the past 10 years and have produced an average yield of 18.2 bushels per acre. Sorghum in a wheat-sorghum-fallow rotation made an average yield of 31.1 bushels per acre. The 10-year average yield for sorghum in rotation is 26.3 bushels per acre.

"A test was also run this year on two methods of land preparation for sorghum production on Class II₂ land. One area was blank listed in the spring and the other area plowed with the stubble mulch sweep plow. Grain yields on the blank listed plot were 27.1 bushels per acre and on the stubble mulch area 31.9 bushels per acre.

"Grain sorghum yields on the terraced plots were reversed this year. The level closed end terraces made an average yield of 24.9 bushels per acre as compared to 22.6 bushels per acre on the graded terraces. This year there was no loss of

crop in the terrace channels on the level terraces. The two previous years a part of the crop was destroyed in the channels by water standing for too long a period of time.

"A land preparation test was also run of these plots representing Class III₂ land. Half of the plots on each type of terraced land were blank listed in the spring and the other half plowed with the stubble mulch sweep plow. In all cases, the stubble mulch tillage produced the highest yields. On the level closed end terrace plots, the stubble mulch tillage made 25.6 bushels per acre and the blank listed 24.3 bushels per acre. The graded terrace plots produced 23.7 bushels per acre on the stubble mulch tillage and 21.5 bushels per acre on the blank listed."

Corn Yields - O. R. Neal, New Brunswick, N. J.

"Yields of sweet corn grown in rotation with a grass-legume sod have averaged 44 percent higher than yields from corn in continuous cultivation. The above figure is the average for the previous 4 years. During the 1951 season this trend continued as shown in the following table:

System No.	Cropping system	Yield - No. 1 ears/A.	
		No.	Wt. lbs.
1	Continuous cultivation	7,910	4,710
2	Sod every third year	10,770	6,660
3	Intensive cover cropping	11,060	6,910
4	Sod and cover crop	11,940	7,620

"Under identical fertilization and treatment during the crop year, the yield from System 4 was 50 percent greater than from System 1.

"These results again lead to conjecture about the economics of these soil and conservation management systems. Production costs vary considerably and market prices for the corn vary widely. However, if it is assumed that total production cost under System 1 was \$200 per acre and price was \$30 per thousand ears the net return would be about \$37 per acre. Under System 4 production cost up to harvest would be the same as for System 1. Harvesting the additional yield would increase the total production cost to around \$225 per acre leaving a net return of \$133 per acre. Thus for each 3 acres of land involved, the grower following System 1 would have \$111 and the System 4 grower would have \$266. Out of the latter figure would have to come the seeding and maintenance cost of 1 acre of sod but there seems no possibility that this would erase the advantage. Once the System 4 rotation is in full operation, it not only contributes greatly to conservation of soil and water but also increases returns from crop production."

Increased Beef Production from Pasture - D. D. Smith, Columbia, Mo.

"The equivalent of 75 bushels of corn per acre was produced on one pasture at the farm this season. Bromegrass-Ladino clover produced 475 pounds of beef per acre by October 23 and is still being grazed with one head per acre. Using the relationship '16 bushels of corn per 100 pounds of beef' gives this corn equivalent. This is a yield of considerable importance when one appreciates the lack of erosion hazard on pastures of this kind. Grazing was completed on Wheat-Korean Lespedeza October 5, with a total production of 319 pounds per acre for the year."

Conservation Practices - H. A. Daniel, Guthrie, Okla.

"The sudan grass established on fields A and B following the vetch on the Red Plains Station made an excellent growth. Thirty steers were placed on these pastures on September 10 and were removed October 8. They made a gain of 32 pounds per acre during the 29 days.

"The conservation value and importance of collecting runoff water from higher, sloping land and spreading it onto lower more level, deep permeable soil is being studied on the Wheatland Conservation Experiment Station, Cherokee, Okla. Terraces were systematically designed on intervals of 1 foot in a (syrup pan) (spread and spill) type arrangement.

"This terraced area has been completely flooded 36 times since the experiment was started. Six of these floodings occurred during the growing season of 1948, 11 in 1949 and 6 in 1950. The rainfall was below average in 1948 extremely high throughout the growing season of 1949 and about average for 1950. As the water moved slowly back and forth over such a large surface much of the surplus was absorbed by the soil.

"The water retained was used advantageously by alfalfa. The yield of alfalfa hay from the terraced 'syrup pan' arrangement and from adjacent untterraced land are as follows:

Treatment	Alfalfa hay, pounds per acrel/			
	1948	1949	1950	Average
Terraced	10,525	12,850	9,843	11,073
Untterraced	5,498	9,949	7,699	7,715
Increase	5,027	2,901	2,144	3,358

¹Rainfall during crop season of 1948 7.8 inches below average; 1949, 15.8 inches above average; and 1950, 1 inch below average.

"This method of spreading and conserving the excess runoff water practically doubled the yield of alfalfa hay during the dry year and also increased it in the wet season.

"Elwell attended the brush tour of the Southwest. He reported that good control of mesquite was being obtained from 3/4 pounds of 2,4,5-T acid in 4 gallons of water and 1 gallon of diesel oil per acre. Best results were obtained when this solution was applied to the vegetation about the time the plants approached full leaf size and in active growing conditions. There were a few sprouts occurred from the roots and in some cases re-treatments were necessary.

"Elwell together with personnel of Chemical Companies and USDA studied results of brush control work near Bartlesville, Pawhuska, and Ardmore, Okla. He reported that aerial applications of 4 pounds of equal parts of 2,4-D and 2,4,5-T acid per acre in diesel oil applied in May and June was producing a good control of oak brush. The species were largely post oak, white oak, and black jack. The best results were obtained where about 2 pounds of this material was applied in two applications by cross flying the area the first year and applying additional annual treatments of 1 pound per acre the second and third year after the first treatment. Where this procedure was followed good stands of native grass developed by the second and third year."

Conservation Practices - A. W. Zingg, Manhattan, Kans.

"Cloudy, damp weather has eliminated possibilities of testing field plots for wind erodibility this fall. Growth of new wheat over all portions of Kansas with the exception of the far southwest corner has been excellent. The favorable growth condition has done much to eliminate a threat of vulnerable soil conditions in the spring of 1952."

Special Summer Weed Control on Grain Land by Subtilling - M. Donnelly, Riverside, Calif.

"Ordinarily, in dry-farm grain cropping in this area, where most of the rain falls in winter, there is not enough moisture left in the soil after grain-cropping to germinate undesirable weeds. Occasionally late rains fall in spring on grain plants that have reached maturity. In this event, and the spring of 1951 was an example, there is enough residual soil moisture to germinate undesirable weeds, such as Russian thistle and tumbling pigweed. These weeds are often concentrated along lines left from previous tillage.

"The economical control of such undesirable weeds has heretofore presented a special problem. Control by heavy work, such as plowing, is neither desirable nor economical. Soil is frequently iron hard and light tools, such as the red-weeder with small shovels, cannot be made to penetrate the ground in proper fashion. What is needed is a tool that will work at a uniform, shallow depth and, in effect, skin cultivate the soil and cut weed roots.

"Trials made in the summer of 1951 on this special weed control problem show that the single shank, wide-blade sweep equipped with medial suspension can be effectively employed. The machine used has a cutting width of 8 feet and an interblade angle of 100°. Weeds were killed by a single pass of the machine. The sweep penetrated readily and could be held at a uniform working depth. The draft of the machine, and hence the work done on the soil by the operation, is light. A crawler tractor, rated at 35 horsepower, pulled the machine in high gear over the ground at the rate of 2 acres per hour."

Legume Plantings - F. L. Duley, Lincoln, Nebr.

"A field day was held on the Hastings project October 23. Among the things demonstrated were a group of legumes not commonly grown in that vicinity, but which may prove to have a valuable place in their agriculture. Among these were several vetches, lespedeza, annual sweet clover, birdsfoot trefoil. Method of inoculating legumes was also demonstrated. Some of the small watersheds showed how a mixture of legumes is being used by seeding on wheat in spring. This is to provide more available nitrogen from the legumes for the following corn crop. On the higher parts of watersheds partridge peas have made more growth than other legumes. On more eroded lower slopes sweet clover has made more growth than any of the other legumes. This results from the high lime content of the soil on the eroded areas.

"F. L. Duley and J. C. Russel visited a demonstration north of Yankton, S. Dak., where C. S. Noble and sons were using multiple hitches for three 8-foot blade tillers. These are giving a good smooth job of subtillage. They also have a new type drill which was brought to Lincoln and tested on our fields here."

Legume Seeding - E. C. Richardson, Auburn, Ala.

"In the fall of 1949, several different possible reseeding legumes were planted on Cecil sandy clay loam at the Piedmont Substation at Camp Hill, Ala., and on Norfolk loamy sand at Auburn, Ala. After maturing seed in 1950, a large tonnage of legume residue and the total yield of seed were turned into the soil and followed with grain sorghum.

"In the fall of 1950, volunteer stands of the different legumes developed slowly. This was due to dry conditions in late summer followed by low temperatures in early winter. Sufficient rain to germinate the winter legume seed did not occur until the middle of November. Following the rain, low temperature either destroyed the young seedlings or interfered with the germination of the seed. This was especially true on the clay soils of the Camp Hill area particularly with the clover-type plants. Button, subterranean, crimson, and Manganese bur clover plants were heaved out of the ground and killed. Vetch-type plants survived the heaving much better than did the clover-type plants; therefore, they survived the winter much better than the clovers. On the sandy soils at Auburn, the clover plants survived the low temperature much better than they did on the clay soils of the Piedmont. Button, subterranean, and Manganese bur clovers produced no growth at the Piedmont Station, while at Auburn all except Manganese bur produced good yields. Manganese bur was killed by frost at Auburn in March 1950 before it made seed; therefore, no seed was available for developing a stand in the fall of 1950. The vetches and peas all produced satisfactory yields at both Auburn and Camp Hill."

Soil Organic Matter Determinations - R. M. Smith, Temple, Tex.

"In the laboratory soil organic matter determinations by depth for the native meadow and the comparable cultivated, eroded soil profile (cultivated for 50 to 60 years), at 6-inch intervals to 3 feet have been completed. The range with increasing depth is from 4.82 percent to 1.0 percent for the meadow compared to 1.92 percent to 0.90 for the cultivated. The data suggest that at least a foot has been eroded off the cultivated profile. Water-stable aggregates larger than 2 mm. diameter determined by wet sieving are correlated with the percentages of organic matter. In the range from 1.5 to 3.0 percent organic matter there seems to be the greatest aggregate increase. The resistance of large aggregates to falling water drops also corresponds with the organic matter values.

"The white face and Angus calves are grazing KR bluestem along with Bermuda grass and buffalo grass. They may not prefer the KR, but they have been eating it readily, even though the heads have been almost mature and the stems rather wiry. Since the frost, the KR has turned very brown and the heads are shattering, but the calves still seem to be eating a good deal of it."

Nitrogen Fertilizer - F. H. Siddoway, St. Anthony, Idaho

"The practice of adding nitrogen fertilizer to dry farm winter wheat has gained momentum the past 2 or 3 years in southeastern Idaho. This practice is a result of decreasing soil fertility through summer-fallow cropping and soil erosion. The experiment station has maintained nitrogen fertilizers should only be used as a supplement to good crop rotations and management. In view of the experiments on the station the past 2 years, for soils and climatic conditions similar to the experiment station farm, it is doubtful if nitrogen fertilizer usage can even be justified on this basis.

"The untreated plots yielded higher than any of the nitrogen fertilizer plots and as the rate of fertilizer application increased there was generally a corresponding decrease in bushel per acre yield. This decrease was not large but was quite consistent throughout.

"The stubble mulch check plots yield 3 bushels per acre more than moldboard plowed plots. The use of nitrogen fertilizer tended to narrow this difference with two exceptions. The 20-pound spring applied nitrogen on the moldboard plowing yielded 1 bushel more than the same application on stubble mulch and the 60-pound spring applied nitrogen yielded 4.2 bushels less than the same application on stubble mulch. The nitrogen fertilizer (ammonium nitrate) was broadcast and apparently the straw residue fixed a sizeable proportion of this available nitrogen in the case of the spring application. The variation in yield for the other two times of application were not so erratic.

"When the experiment was started it was felt the nitrogen applied early would be fixed by the residue and therefore released for crop use more uniformly. The yields from the different data of application tend to confirm this hypothesis. A dry growing season such as the last is one of the hazards to consider when contemplating the use of nitrogen fertilizer in a dry farm area. If rainfall had been even normal, the results may have been much different.

"It is difficult to hypothesize what might happen in a normal year from negative results obtained in an abnormal rainfall year. However, these dry periods can and do occur and should be considered in recommending the use of nitrogen fertilizer. Not only was the cost of the nitrogen fertilizer lost but the reduction in yield was also considerable."

Conservation Practices - T. L. Copley, Raleigh, N. Car.

Rotations Affect Nematode Damage - "Root knot nematode damage has been severe in many of the tobacco plots on the station and there has been general complaint over the tobacco in all the 1-year rotations. The 2-year rotations were much better, regardless of whether the preceding crop was some other row crop such as cotton, corn or peanuts, or was small grain with grass or some other interplanted crop.

"Dr. C. J. Musbaum and Mr. F. A. Todd of the State College Plant Pathology Department, are cooperating in a nematode count in the tobacco rotation plots to determine the effect of different treatments, and the results of these counts will be available as soon as calculations have been completed.

"Since tobacco follows tobacco in certain treatments of our tobacco rotation experiment and nematode damage would be expected to continue, it has been necessary to use soil fumigation on all continuous tobacco plots this fall before seeding to winter cover. Mr. Todd cooperated in this job and gave us necessary supervision. He also loaned us tractor attachments for doing the job.

Mulch Balk Continues Effective - "May is the only month in which the no-winter cover plot shows a higher soil loss than any other plot. Effects of early-turned rye and rye grass disappeared after May, while effects of late-turned rye continued through July. The mulch-balk treatment was highly effective throughout the period. All of which tends to bring out more clearly that the beneficial effects of the cover crop is proportional to the amount of undecomposed residue remaining on the ground surface, and that incorporated material has little or no

effect on the erosion of a sandy loam soil on land slopes and row grades such as used in this experiment.

"Crop-yield data are not yet completed, but observations indicate that both yield and quality of tobacco in the mulch-balk plots were as good as for most other treatments. This has been of particular interest since crop yields in mulch-balk tests at Watkinsville, Ga., have not been favorable, according to reports by Hendrickson and Carreker.

Rainfall Requirement for Tobacco - "Current interest in water requirement for tobacco prompted an examination of our rainfall records for the tobacco growing season during the past 10 years, particularly the seasons which were considered good. This study revealed that during the so-called good years when growth appeared to be normal and final yields were good, rainfall minus runoff averaged from 0.75 to 1.00 inches per week.

"This indicates that supplemental irrigation above these amounts would not be necessary. Accumulative line graphs, showing these rainfall patterns have been prepared and will be made available to Operations personnel."

Winter Ridging for Soil Protection - C. S. Britt, Beltsville, Md.

"Tests at this station have indicated that freezing and thawing of soils during the winter does not harm soils as much when the water content is low as when the water content is high. For this reason a field experiment was started during the winter of 1949-50 on a Christiana silt loam soil which normally is extremely wet over winter. Three plots were ridged over winter with a 1 percent grade ridge to improve surface drainage, while three plots were left flat with normal drainage. All of the plots were covered with a good growth of vegetation in the summer of 1950 and the winter of 1950-51.

"The entire area was plowed for corn in the spring of 1951 and the plots were subdivided into replicated ridged and non-ridged sections. The following conditions were then represented: ridged in winter and summer, flat in winter and summer, flat in winter and ridged in summer.

"As noted in the June report in 1951, all the corn that was plated on the flat failed to produce a stand. Failure to get a stand on the flat land limits our yield observations to land that was planted on ridges during the growing season of 1951. The fact that 99 percent of the flat planted corn rotted and failed to germinate, whereas the ridged corn gave normal stands reflects wide differences in soil factors affecting germination."

Irrigation Studies - J. Vincente-Chandler, Rio Piedras, Puerto Rico

"The final data from the large scale field experiment with sugarcane at Aguirre using nylon electrical resistance blocks as guides for irrigation have been summarized. Two moisture and two nitrogen levels were used. The fields with the 'dry' treatment were irrigated when the soil dried out to moisture tensions equivalent to about one atmosphere; those with the 'wet' treatment when tensions equivalent to about 1/2 of an atmosphere developed. All fields received 400 pounds per acre of 12-4-10 fertilizer in the first application, and 600 pounds of ammonium sulphate in the second. An additional 400 pounds per acre of ammonium sulphate was applied at this time to the fields with the high nitrogen treatments.

"There was no significant effect of nitrogen or moisture level on either cane or sugar yields. The lack of response to the moisture levels used in this experiment was expected and further corroborated previous findings at Aguirre. These had shown that soil-moisture tensions below those required to actually kill the sugarcane had no effect on yields.

"The lack of response to additional nitrogen was a surprise. It is difficult to conceive that the maximum yield potential of the sugarcane has been realized at these nitrogen levels. No gross nutritional unbalance seems likely. The lack of response to nitrogen at both moisture levels leads one to discount the possibility of high leaching losses as the primary cause. It is of course possible that both moisture levels caused approximately equal losses of nitrogen through leaching but this does not appear probable. It may be that other factors such as damage to the cane by grubs overshadowed the effect of nitrogen levels. Data from one entire (9 acres) field was not used due to extremely heavy damage by grubs. Also, losses of nitrogen as ammonia gas may occur in these rather alkaline soils, (pH values ranged from about 7 to 8) following heavy applications of ammonium sulphate. Whatever the explanation, it appears that 400 lbs. per acre of ammonium sulphate costing about \$14.00 were largely wasted when applied in this way.

"There was no effect of moisture level on 96° sugar yields. This bears out our previous findings. It is however, contrary to the general opinion held by sugarcane farmers who believe that excess moisture during the season when the cane is maturing reduces the percent of sugar in the cane.

"Approximately 20 inches less water were applied on the average to the fields with the dry treatment without affecting yields. Three man-days of work per acre were saved in this way. The greater available storage capacity of the soil at the time of irrigation in the fields with the dry treatment with a consequent increase in the efficiency of applications was one of the reasons for this saving of water. Consumptive use was also probably lower in these fields."

ECA Farm Management Seminar - E. L. Sauer, Urbana, Ill.

"An ECA farm management seminar was held at the University of Illinois October 1-27. Thirty-one European visitors from 10 countries were represented. Our work in the economics of soil conservation occupied approximately 2 days of this seminar. Illustrated lectures on the costs and benefits of soil conservation were presented to this group."

DIVISION OF DRAINAGE AND WATER CONTROL

Hydrologic Studies - L. L. Harrold, North Appalachian Experimental Watershed, Coshocton, Ohio

"Rainfall of 1.84 inches which was considerably below normal caused no surface runoff. Ground-water levels continued to fall slowly during the month to very low elevations. Soil-moisture content was only slightly above the minimum (near wilting point) values reached near the end of the growing season. With the 3-month rainfall of over 5 inches less than normal by the end of October, saturation deficiency in the 0- to 14-inch soil depth amounted to about 4.3 inches of water.

"Subsoil tillage shattered and loosened the soil to depth of 15 inches. Soil samples will be taken for volume-weight determinations to reflect the changes caused by subsoiling and the durability of such changes.

"Yield of corn on the plowed and mulch plots (table 1) was somewhat erratic--there being no significant difference.

Table 1.--Corn yield on plowed and mulch plots, watershed, and strips, 1951

Treatment	Yield	Stand
	per acre Bushels	per acre Number
Plowed	67.7	14,900
Plowed, field cultivator pulled up residue for mulch	73.8	14,800
Disked mulch	66.7	15,000
Watershed - plowed	68.6	11,700
Watershed - 4" plow depth for residue mulch, 9" subsoiled	86.5	19,100
Strip - plowed, manure mulch at emergence time	107.8	18,800

"The shallow plowed watershed after fitting with a disk and drag harrow provided a fair amount of surface mulch. There was no runoff or erosion from this watershed during the entire summer. Corn yield of 86.5 bushels per acre was quite satisfactory.

"The corn strip normally plowed, fitted and planted was manure mulched about the time of corn plant emergence. There was no weed problem or cultivation problem in this strip. Yield of 107.8 bushels per acre was the best on the station this year.

"Mr. Dreibelbis reports that the soil aggregation on the mulched plots at the end of two complete 4-year rotations was better than that on the plowed plots. The latter plots have a greater percent of fines. Results are summarized in table 2.

Table 2.--Aggregate analysis of plowed and mulch corn plots, sampled 4/18/51 (percent of parent material not shown)

Size of aggregates	Soil depth					
	0-1"		1-4"		4-7"	
	Plowed	Mulch	Plowed	Mulch	Plowed	Mulch
Total aggregates > 0.2 mm.	Percent 22.7	Percent 36.4	Percent 17.9	Percent 30.4	Percent 18.4	Percent 27.9
Total fines < 0.2 mm.	38.5	31.4	46.6	31.7	43.6	36.2

"A survey of rentals in this area was made for the basis of recommendation for rental rates of Government-owned buildings to Government employees. The Ohio Rental Survey Board appointed by Regional Director, R. H. Musser, met at the Station to review the survey and recommend rates. The results were transmitted to Milwaukee for consideration."

Hydrologic Studies - R. W. Baird, Blacklands Experimental Watershed, Tanco, Tex.

"Rains the last week of October totaling 1.31 inches at gage No. 69 were the only precipitation for the month. These rains were not sufficient to cause runoff from any areas. Total rainfall for the year to date has been 23.14 inches compared to a normal for this period of 29.54 inches. Drought conditions, however, have been worse than these figures indicate due to the very dry fall of 1950 with only 2.45 inches rain during October, November, and December compared to the normal of 8.09 inches. The rains of September with the light rains of October have been sufficient to start fall planted oats and some of the clovers. Soil-moisture conditions now are better than at the same period last year. There has been no runoff of any consequence from areas within the Government-owned land since February 1950. Some areas of mixed soils had considerable runoff during the rain of September 12-13, 1951.

"The percentages of moisture on the cultivated areas of Y-10 and W-10 watersheds on October 18, at the designated depth intervals were as follows:

Y-10, Area: 0-6 inches, 18.4 percent; 6-12 inches, 26.5 percent; 12-24 inches, 25.6 percent, and 24-36 inches, 26.1 percent.

W-10, Area: 0-6 inches, 14.9 percent; 6-12 inches, 25.4 percent; 12-24 inches, 23.7 percent, and 24-36 inches, 20.0 percent.

"The highest field average of cotton produced this season on the Government-operated farm unit was on an area with a 3-year cropping system consisting of cotton, corn, and oats with Hubam clover interplanted with the oats as a soil improving crop. The yield was 244 pounds of lint per acre. The average for this system on four fields was 233 pounds per acre in comparison to only 166 pounds from the conventional cropped area where 50 percent of the area is in cotton each year without conservation measures and a soil improving crop in the system. The increase in yield this season was attributed primarily to the moisture conservation on the terraced and contour cultivated areas. Insect control measures were applied on both systems. The difference between the average production on the conservation farmed system and the conventional system represents a 40 percent increase in favor of the conservation system.

"One day this month was spent with Mr. Andrews in Fort Worth working on the hydrology problems of the Blacklands. Data from this project are being assembled to assist in this work. With more work in the upper reaches of the Trinity, data from this project are particularly applicable. Mr. P. H. Price, Engineer from the Regional Office; together with six of the engineers in the Blacklands area spent 1 day at the Project working on design tables for runoff from small areas within the Blacklands. Data from Technical Bulletin No. 1022, 'Rates and Amounts of Runoff for the Blacklands of Texas,' is being used as a basis for these tables. The attempt will be to simplify recommendations so that many of the small installations can be planned by work units without the detail planning now required by the District and Area Engineers."

Hydrologic Studies - J. A. Allis, Central Great Plains Experimental Watershed, Hastings, Nebr.

"In October, 1.85 inches of rain was measured at the Meteorological Station which is 0.40 inch above the long-time average. The rains were fairly well distributed over the month with the daily readings all less than 0.48 inch. The monthly temperature was about 2.2 below average.

"The winter wheat has made good progress and with the unusually high moisture content in the ground we can expect an above average wheat yield next year. Corn harvest got under way during the last part of the month with quite a variation in yields being reported. Corn samples taken on some replant corn in the project area showed 38 percent moisture content at the end of the month. The corn on the 4-acre watersheds was not replant corn and generally was believed safe to store.

"Watersheds 6-H and 7-H, side by side on the project area, have been farmed as one field for the past 5 years except that we farmed 6-H in straight rows and 7-H on the contour. These two watersheds are practically identical in slopes, soils, and average depth of topsoil. This year the corn yields on 6-H which is farmed in straight rows averaged 45 bushels per acre while on 7-H which was on the contour averaged 62 bushels per acre. This represents an increase of 17 bushels per acre or at the current price of corn was worth \$26 more per acre. Yields on a subtitled watershed with a greater slope and less depth of topsoil was 46 bushels per acre. The average yields of the duplicate corn watersheds under the three practices will be available in the near future."

Hydrologic Studies - R. B. Hickok, Lafayette, Ind.

"Soybean yields were adversely affected by volunteer corn growth, particularly on the conservation treated watersheds.

"Sample harvesting of corn on the watersheds was completed. Results will be included in a subsequent report.

"The following table reports soybean yields on the watersheds:

Table 1.--1951 Soybean Yields from experimental watersheds, Purdue-Throckmorton Farm, Lafayette, Ind.

Treatment ^{1/}	Wsd. No.	Yield est., bu./a. ^{2/}	
		Mean	Standard error
Conservation	6	36.1	0.98
	7	37.7	.88
	Av.	36.9	.80
Prevailing	5	28.4	0.66
	8	28.9	.85
	Av.	28.6	.26
Treatment difference		8.3	Highly Significant

^{1/}Conservation treatment included contour seeding and cultivation of soybeans. Prevailing treatment included straight row seeding and cultivation. Row width was approximately 38 inches on all watersheds growing soybeans. No fertilizer was applied to crops under either treatment, but the conservation watersheds benefited from heavy fertilization of corn grown the previous year.

^{2/}Samples 7' x 6.2' at 60' x 60' intervals. Yields corrected to 13-1/2 percent moisture using 60 lb. per bushel.

"Sample harvesting of experiment plots was completed at Albion. Analysis of the data confirmed the observation that Helminthosporium damage was related to location. Distinct direction trends in the yields were found, permitting a correction. The

yield results at Albion fall in line very well with previous years' results. The corrected yield for shallow mixed residue and deep tillage treatment (using the Oliver TNT plow, with the lower shear at usual plow depth and the upper shear and moldboard merely turning over the turf) was 112.0 bushels per acre, compared with 99.4 for conventional plowing. The same experimental treatment with initial tillage in the fall produced an adjusted yield of 107.4 bushels per acre."

Hydrologic Studies - L. H. Stolzy, East Lansing, Mich.

"On October 27 Dr. Kenworthy, from the Horticulture Department, Mr. Kidder, from Agricultural Engineering, and the Acting Project Supervisor met with Mr. Paul Shaw, a cherry grower from the Traverse City region to discuss the possibilities of supplemental irrigation in connection with his cherry orchards. It was felt by Mr. Shaw that if the costs were not too high, it would pay him to irrigate, as well as give interested College personnel a chance to do some needed research on supplemental irrigation in cherry orchards. Recommendations were withheld until a survey of the area could be made."

Hydraulic Studies - W. O. Ree, Stillwater, Okla.

"New construction during the month included two new supply canal cut-off gates. These gates are provided with hoists so they can be readily opened or closed. They replace the fixed type and provide for greater speed and flexibility in the testing activities. Also completed was a special form in which to cast weir sills to be used in the runoff studies. These sills are to be placed on the floors of the culverts which are used for rate measuring devices. They are being cast of concrete having a light weight aggregate. Casting the weir sills is simpler than framing them of lumber. Also a more durable sill results.

"During the month tests were made on the King Ranch Bluestem channel FC-8. This channel is V-shaped with a width of 40 feet and a depth of 2 feet. Its slope is 6 percent and its length about 300 feet. It was seeded in the spring of 1948 and first tested in the fall of 1950. The stand for those first tests was rather poor. Mr. Nixon, the regional agronomist suggested that the channel be tested with the poor cover and then fertilized to improve the cover and then tested again. This was done with the final tests run this month. The data for the final tests have not yet been analyzed but indications are the improved cover has increased the retardance and the permissible velocity.

"Considerable time has been spent on analyzing the data from the pipe outlet experiments run during September. The following preliminary results are available:

Friction factor, f , for 24" concrete pipe	0.0201
Friction factor, f , for 24" corrugated pipe	.0710
Elbow coefficient	.82
Entrance coefficient, pipe groove	.33
Entrance coefficient, 3" radius rounded	.28

"The 24-inch concrete pipe is culvert pipe with a joint every 4 feet. The corrugated pipe is full coated, paved invert. The elbow is made of sections of corrugated pipe and provides a total deflection of 84°.

"The values for the elbow and entrance coefficients are higher than previously established values. An explanation for this is still being sought. The drop-inlet experiments were not completely satisfactory. The 8-foot drop inlet will be tested again in November."

Supplemental Irrigation Studies - J. R. Carreker, Athens, Ga.

"W. B. Land reports the following measurements during October:

Rainfall 10/21/24 = 0.50", 10/28 = 0.65, 10/30 = 0.60 = 1.75" total, or 1.16 less than the long-time average. Evaporation = 3.93 inches, wind movement = 444 miles, Maximum temperature = 95 on October 6, minimum temperature = 30 on October 12.

"The soil moisture was very low during the first 3 weeks. The slow rains and cloudy foggy weather the last week replenished the moisture in the surface soil, but did not affect the declining water table.

"Harvesting the field corn plots at the Watkinsville station was completed in October. The irrigated plots were given applications of 1.5 inches on June 28 and July 11 during dry spells. The average yields were:

Irrigated = 73.4 bu. per acre
Unirrigated = 50.2 bu. per acre
Difference = 23.2 bu. per acre

"Cotton was irrigated in three plots within one terrace of a field planting at the Watkinsville Station. Irrigation applications were 6/29 = 1.0 inches, 7/10 = 1.5 inches, 8/9 = 1.5 inches. All other treatments were uniform in the entire area. Harvest records showed the following results in seed cotton yield:

Date	Unirrigated	Irrigated	Increase with irrigation
	<u>Lb/ac</u>	<u>Lb/ac</u>	<u>Lb/ac</u>
8/30	578	268	-310
9/19	1,487	1,844	357
10/15	100	416	316
Total	2,165	2,428	363

"Yields of sweetpotatoes, irrigated and unirrigated, from plots on the University farm are given in table 1. The irrigated plots were watered with the sprinklers as follows: 8/7 - 1.5 inches, 8/16 - 1.0 inches, 9/6 - 1.5 inches.

Table 1.--Yield of sweetpotatoes by grades in 1951
bushels per acre

Plot No. 1/	Plants per plot	Yield of potatoes				Treatment
		No. 1	No. 2	Strings	Total	
3	94	172.0	142.5	34.5	349.0	Check
4	89	143.2	156.8	47.2	347.2	"
8	83	92.3	66.7	51.9	213.9	"
Av.	89	135.8	122.0	45.5	303.4	"
2	84	177.2	118.8	20.9	316.9	Irrigated
5	84	158.0	143.4	51.6	353.0	"
6	78	136.2	118.3	65.0	319.5	"
Av.	82	157.1	126.8	45.8	329.7	"

Irrigated increase over check 25.1 = not significant at the 5 percent level.
1/Plots 1 and 8, irrigated and unirrigated, respectively, omitted because of poor stand.

"Observations of soil moisture throughout the season indicated that these applications kept the soil fairly moist at all times. The unirrigated plots became quite dry, however. The lack of any appreciable increase in yields with the irrigation cannot be adequately explained at this time."

Drainage Studies - J. C. Stephens, West Palm Beach, Fla.

"Public release was made of the report 'Subsidence of Peat Soils in the Everglades Region of Florida' at a meeting of the Soil Science Society of Florida at West Palm Beach on October 29. This bulletin is a cooperative report issued by the Division of Water Control, SCS, Central and Southern Florida Flood Control District, Everglades Drainage District and the Florida Agricultural Experiment Station.

"At the meeting a brief resumé was given by the Project Supervisor and Mr. Lamar Johnson, engineer for the C&SFFCD, authors of the report, to stress the fact that the final disappearance of the organic soils in the upper Everglades area was a matter of only approximately 50 to 60 years. The need for better water control and use of the drained land for agricultural purposes to produce maximum yields at minimum rates of soil loss was stressed. The release of this information during the Soil Science group's meeting brought protests from some landowners that the report was too pessimistic, coupled with the promise from other owners and technicians of better water and land-use practices in the future. It is believed that this report will serve to arouse to action many of those concerned with the future fate of the Everglades soils so that the life of this natural resource can be prolonged insofar as possible.

"At the Everglades Experiment Station a test was performed in an attempt to determine the maximum water tolerance of the kenaf planted in the six soil tanks at the Everglades Experiment Station. Since July 20, 1951, when the crop was planted, the water tables have been held at 12 inches in two tanks, 18 inches in two other tanks, and 24 inches in the remaining pair of tanks. Commencing at 6:00 a. m. on October 22, 7.71 inches of water, representing a 24-hour storm of 10-year period, were sprinkled in hourly increments on three of the tanks, one at each of the three water tables. Also at 6:00 a. m., October 22, water began to be withdrawn, at a rate representing a 2-inch drainage capacity in 24 hours, from the bottom of the three tanks which were being sprinkled. Observations were made of the rise of the water table in these three tanks, and, when the water table in each rose to 3 inches below the ground surface, the twin tank, the one whose crop was grown at the same water table, was flooded immediately to a depth of 3 inches above the ground surface. At 5:00 a. m., on October 23, the sprinkling was discontinued while the rate of removal was maintained on the three sprinkled tanks. When the water table receded to 3 inches below the ground surface in the sprinkled tanks, the twin tank which had been flooded 3 inches deep was drawn down immediately to its original water-table depth. The withdrawal rate was continued on the three sprinkled tanks until the water table in each returned to its original depth of 12 inches, 18 inches, or 24 inches.

"There was no apparent damage to the kenaf in any of the tanks. The 24-inch water-table tank which had been flooded almost instantaneously has had the water held between ground surface and 3-inch depth over ground surface since 3:00 a. m., October 23. This tank will be kept flooded until some damage to the crop becomes apparent. Aside from economic factors, plant diseases and wind damage appear to be the major limitations to growing kenaf.

"On October 22, the second seeding of Pensacola bahia grass was made on each test plot along the Cypress Creek Canal to determine the residual toxicity of the various herbicides used in control of para grass. A strip 10 feet wide was seeded

from the water's edge laterally across the canal bank to the untreated edge of each test plot. An inspection of similar seedings which had been made September 19, 1951, on each plot, showed that almost none of the seeds had sprouted. To establish a basis for comparison of growth on the various seedings, an untreated area of the canal bank, comparable in size and vegetative condition to the test strips, was also seeded to bahia.

"A follow-up inspection on October 23, 1951, of the growth inhibiting effect of the various herbicides used on the test plots for control of para grass, indicated that CMU Weed Killer is the most potent of the herbicides used in the tests.

"Mr. Charles Seale, agronomist from the Everglades Experiment Station, assisted in the inspection. His ratings were combined and averaged with this Project Supervisor's and Mr. Speir's individual ratings of each test plot in an effort to minimize the personal error in comparatively rating the 48 test plots. The Project Supervisor and Mr. Seale's ratings were made on a comparative basis. A detailed tabulation of these findings can be obtained from the project.

"A standard concentration of 1 pound of herbicide to 1 gallon of water was used in all treatments where the rate of application produced a minimum of 10 gallons of solution as our spraying equipment required a minimum of 10 gallons for coverage of each plot. In one group, Polybor-Chlorate was used at a concentration of 1.3 lbs. to 1 gallon of water.

"It is apparent that the best results were produced by the CMU Weed Killer, or Para-Chlorophenyl-1, 1-dimethylurea. It is hoped to continue tests with this material under field conditions at varying rates. As this herbicide is still undergoing tests and has not yet been released for sale by the DuPont Chemical Corporation, who owns the patent, the comparative cost is not known.

"In the next group very good results were obtained by pre-treating the para grass with a contact killer for defoliation, later followed by a soil sterilizing agent.

"A third group of single-treatment, soil-sterilizing materials produced fair results. The addition of detergents, Triton emulsifier, kerosene, or Xylol, to these materials seemed to have little influence on the lasting effect of the herbicides.

"In the fourth group, with almost negligible results, it is apparent that the contact killers used have little lasting effectiveness in killing para grass when used alone, though excellent results were obtained when used for defoliation.

"It is thought that Polybor-Chlorate, though effective for small areas when used at recommended rates, could not economically compete with the other herbicides tested for eradication of para grass under farm conditions."

Drainage Studies - M. H. Gallatin, Homestead, Fla.

"With high summer temperatures and moderate rainfall there has been a rapid release of nitrate for the pine straw and grass mulch areas. Samples collected on the October 12, 1951, analyzed as follows: Natural cover 1.0 p. p. m; shavings 1.4 p. p. m.; check 1.0; pine straw 41.5 p. p. m.; and grass 62.0 p. p. m. During periods of warm weather with enough rainfall to maintain good moisture condition to release of nitrate increases in these plots. Though the shavings are breaking down if there is a release of nitrate it is probably used up by the bacteria. There has been a definite change in the physical make-up of the surface soil for the pine straw and grass mulched areas but the soil beneath the shavings mulched plot has if

anything become lighter in color and more plastic.

"With frequent showers from the 1st to the 20th of October readings for all the plots remained low. From the 20th to the end of the period readings in the natural cover and check plot areas increased rapidly.

"Toward the end of the period, the readings on the cycle plot (sunland moisture irrigation plot) were close to the wilting point and it was recommended that this plot be irrigated. Data to date show that with a somewhat lower water table this year than previous years. The tree and truck crops reach the critical point earlier.

"With only showers of relatively low intensity occurring during this period, little or no losses occurred through leaching. There is no doubt that during these periods of low rainfall and relatively high temperatures we can expect rather high losses of nitrates as ammonia. While we have not had time to carry on any research regarding this recent work in California and work some years ago in the tropics on soil if pH 7.0 or above showed losses ranging from 15 - 35 percent of applied material in a rather short time. Recent work in California collaborates this and goes further in that through process of wetting and drying the entire application was lost through volatilization.

"With low rainfall little or no pumping will be necessary to get this area ready for plowing. A small low pressure experimental sprayer designed on this project was completed this period. Two or three of the most promising materials used to control grasses will be tried in the control of grasses and weeds in the perimeter canals of the Highlands Water Control Plot. If material is available before planting test areas will be sprayed with such materials as T. C. A. to determine the amounts necessary, and also cost of control.

"We should like to pass onto other projects, some of the equipment that was designed at this office. For use in stirring soil samples a no-splash stirrer has been designed. This stirrer even at high speeds will not throw the stirred soil-water mixture out of the container. A vacuum filter was designed. The use of this filter eliminates the use of funnels. Samples that require 3-6 minutes can be filtered in 30 seconds to less than a minute. When fine materials as marls are filtered a battery of two of these filters are used. With this equipment using two stirrers as many as 180 to 200 samples have been extracted in a day. We shall be glad to furnish drawings of any of these pieces of equipment should any of the projects have use for equipment of this type."

*Loss of Ammonia Nitrogen from Surface Fertilized Soils - J. B. Martin and H. B. Chapman.

Drainage Studies - E. G. Discker, Raleigh, N. C.

"Due to the normal high water tables, flood tides, and wind tides it is necessary for some farmers in Hyde County (Pamlico District), in the area around the lake section, to use dams and pump in the main drainage ditches. There are a number of commercial pumps and homemade pumps in operation in this area. The initial cost of the homemade pumps is extremely low as compared to that of the manufactured pump. The writer was advised at one time that the cost of the homemade pump was from \$100.00 to \$150.00, whereas he was advised that a 14-inch Cough pump with motor costs about \$1,500.00. Farmers are well pleased with the results of these pumps, and from observation it appeared that they were rather efficient. However, they would be much more efficient if they were constructed with a submerged outlet,

similar to the Couch pump, whereby the syphon principle could be utilized. A local machinist made these pumps, and the general appearance is that of a non-reversible Couch pump. However, most all of them have a free overfall above the discharge water level. The majority of them are made by welding two hot water tanks together, with the discharge end being horizontal, whereas the intake section is about 45 degrees angle with the vertical. The impeller is an inboard motor boat propeller, equipped with a large shaft with proper bearings at each end. One of these is operated with tractor power take off, others by stationery gasoline engines with pulley and belts, but the majority are operated with tractors from the belt pulley.

"The district conservationist and the local Soil Conservation Service technician have requested the writer to determine the capacity of these pumps. Recently, the discharge and fuel consumption was measured on four homemade pumps and on one commercial pump. The water velocities were measured with a current meter, employing the standard procedures. The results are given in a table which can be secured from the project.

"In connection with the Plymouth experiment, spot checks of corn yields were made this year on some of the drainage plots. These results are shown in the table below:

Plot	Type drainage	Drainage spacing (ft.)	Drainage depth (ft.)	Corn yields in bu. per acre
C	Open ditches w/o spoil banks	50	3	90.7
C	Open ditches w/spoil banks	100	3	92.4
C	Open ditches w/o spoil banks	230	3	74.7
D	Single bed drains	60	1	80.8
D	Single bed drains	120	1	92.4
D	Double bed drains	60	1	79.2
D	Double bed drains	120	1	89.1
D	Blasted ditches	50	3	99.0
D	Blasted ditches	200	3	90.7
E	Tile	75	2	82.5
E	Tile	75	3	92.4
E	Tile	75	4	74.3

"Due to the large area from which the yields were taken and to the possibility of soil and fertility differences it is doubtful as to just what effect the drainage variable had on the yields. Observations indicated that yields were definitely reduced by abnormally low precipitation."

Drainage Studies - I. L. Saveson, Baton Rouge, La.

"The 65-acre test area on Cinclair Plantation was planted during the middle of October. Four cuts of approximately 12 acres were planted flat. The same problem was encountered in planting as in previous years. The tractor wheels packing the earth between the rows forming a small middle. If the growing of sugarcane on the flat proves advantageous and becomes an accepted practice, it will be desirable to have some agency or manufacturer develop a planter which will overcome this difficulty."

Drainage Studies - T. W. Edministration, Blacksburg, Va.

Mr. Walker reports, in view of the difficulties with the drainage formulae, "the best check on the suitability of the formulae seems to be to reproduce the draw-down curves from actual field permeability measurements and compare them with those curves obtained from field measurements of water tables. Under such a scheme, curves of similar pattern signify that the formulae are applicable. The placement of the curves on the soil profile is indicative of the accuracy of the soil permeability measurement."

"This test is in progress. However, it is a slow mathematical process and no results have been obtained."

"In reviewing data of this nature, several observations may be noted. In most cases, the water-table measurements are excellent. They are well chosen to show water-table recession from high stage with no precipitation occurring within the period. On the other hand the soil profile and permeability data are lacking. Many of the permeability determinations do not measure permeability of some of the deeper soil layers that affect the water-table pattern. In other cases the crest of the draw-down curves do not occur at the midpoint between drain laterals but are near one lateral. With drains located approximately at equal depths and the same relative elevation, it is evident that this skewed pattern of draw-down curves is due to differences in soil permeability near the drains. However, the soil-profile description implies, at least, that the one (usually) permeability determination that was made is characteristic of the entire area under observation. It is evident that this point needs more careful consideration."

"Mr. Walker also reports that considerable progress has been made in preparing a paper on the above analytical procedures which is to be presented at the ASAE meeting in December. Mr. Walker's paper that was presented before the Soil Science meeting in August has been revised to incorporate many of the suggestions made by Mr. Uhland and his associates and has been sent to the Soil Science Editor."

Drainage Studies - C. B. Gay, Fleming, Ga.

"The Coastal Bermuda and Pensacola Bahia have continued to make very good growth throughout the month. The 10 acres of Kentucky-31 Fescue and Ladino Clover were fertilized and made an excellent new growth during the last 3 weeks of the month. The plot of Coastal Bermuda beside the plot of Kentucky-31 Fescue and Ladino presents a very interesting picture in that the Coastal Bermuda will furnish good

grazing through October in this locality, and the Fescue-Ladino Clover mixture has made sufficient growth that livestock could be moved from the Bermuda Grass to the Fescue-Ladino Clover by the end of October. It is possible that these two might be our best for year-round grazing and on these soils with average fertilization would possibly carry two to three cows per acre. The seed were combined on the Pensacola Bahia plot but due to improper adjustment on the combine we saved only about 200 pounds of seed. The Bahia is continuing to grow and would also be a good grazing crop through October."

Sedimentation Studies - L. M. Glymph, Jr., Lincoln, Nebr.

"Computations of original and remaining capacities and sediment volumes determined by the sedimentation survey made on this lake (Sabetha Reservoir) last spring were made but not completely checked. The preliminary figures show this 9-square mile watershed to have the highest rate of sediment production of which we have any record in the Mixed Loess and Till Prairies area in eastern Kansas and southeastern Nebraska. Two days were spent on field work studying sediment sources in the watershed. A high percentage of the watershed is under cultivation."

Sedimentation Studies - P. Woodburn, State College, Miss.

"Calculations were completed for some preliminary values of sediment production rates for Pontotoc Ridge gullies and this is covered by a short special report which appears below:

"The Pontotoc Ridge soil province covers extensive areas of the upper portion of the Tallahatchie River sub-watershed of the Yazoo flood control area. Gullying is common and is frequently extensive particularly in the deeper sand areas. Data on rates of sediment production from such gullies are necessary for proper and adequate design of impounding structures for water and/or soil.

"Experiments have been set up to compare splash erosion rates of the gully soils in this area with splash rates from gullies in Lafayette county in the Tallahatchie formation where sediment production rates have been measured in debris basins. Until conclusions may be reached from these experiments, no design data are available.

"In order to have preliminary interim data, studies were made on some new debris basins in the Pontotoc Ridge, constructed December 1949. No cross-section surveys were made in these basins at the time of construction.

"In September 1951 several of these basins were mapped and the sand deposits were sounded for an approximate determination of volume. Soundings were made only because cross sections were not available. It is highly probable that some error attended these soundings as there was a sand deposit on top of an old sand bottom and a clear cut delineation of the old bottom of the pool was not always possible.

"Three basins were found suitable for study. The findings are as follows:

<u>Name</u>	<u>Net gullied area</u>	<u>Sed. prod. rate</u>
Tommy Hobson	0.433	3.22 in/yr.
M. A. Russell	.333	2.61 in/yr.
F. J. Warren	.495	1.75 in/yr.

Rainfall December 25, 1949, to September 25, 1951 - 85.83 inches.
Long-time average 34.1 percent less than above.

"It may, therefore, be seen that the sediment production rate is very high from such gullies although these rates should probably be reduced somewhat due to a chance of over measurement in sounding and due to over normal rainfall during the period of sediment accumulation.

Av. of 3 is	2.53 in. per year
Reduce by 34.1 percent	.85
Probable average rate	<u>1.68</u> in. per year

"It is recommended that about 2 inch/yr. would be satisfactory for design purposes or about the same as the Tallahatta formation gullies.

"It should be recognized that gullies in the northern part of the Pontotoc Ridge frequently do not cut down into the loose sand formation common to the south portion where the three studies were located. As we learn more about the situation, it may be necessary to have two or more rates. The hard red compacted material common to the gullies in the north part of the area and also found in the upper part of the gullies throughout the area probably has a different rate from the loose sandy material.

"In the three gullies studied, there were three different erosion conditions as follows: (1) Ungullied watershed outside rim of gully, (2) within rim of gully a hard red clayey sand material, and (3) within rim and within No. (2) a loose unconsolidated sandy material.

"Three gullies were inadequate for study, but an attempt was made to determine analytically the erosion rate for each soil condition found in the three gullies as follows:

Let X = erosion rate of condition (1) Inches per year
Y = erosion rate of condition (2) Inches per year
Z = erosion rate of condition (3) Inches per year
Let A₁, B₁, and C₁ = areas of each erosion condition in 1st gully-acres
Let A₂, B₂, and C₂ = areas of each condition in 2d gully-acres
Let A₃, B₃, and C₃ = areas in each condition in 3d gully-acres
Let K₁, K₂, and K₃ = sediment in gully pools, for gullies 1, 2, and 3.

Then:

$$\begin{aligned}(1) & A_1 X + B_1 Y + C_1 Z = K_1 \\(2) & A_2 X + B_2 Y + C_2 Z = K_2 \\(3) & A_3 X + B_3 Y + C_3 Z = K_3\end{aligned}$$

"These equations are set up with the condition that the erosion rate for erosion conditions No. 1, 2, and 3 are the same from gully to gully. Theoretically, this may be considered true but actually there is undoubtedly variation from gully to gully. This variation could be ironed out only through extensive sampling of many more than three gullies. Although the mathematics involved will be infallible, the natural variation may cause fantastic and impossible answers in the solution.

"The equations with the constants evaluated are:

$$\begin{aligned}0.191 X + 0.296 Y + 0.135 Z &= 1.32 \text{ Ac.-In.} \\0.114 X + 0.227 Y + 0.095 Z &= 1.10 \text{ Ac.-In.} \\0.153 X + 0.403 Y + 0.137 Z &= 0.87 \text{ Ac.-In.}\end{aligned}$$

"The fallacy of attempting this analysis with only three cases is well borne out by the amusing nature of the values which result from the solution of the three equations simulataneously.

X = -19.688 In./yr.

Y = -12.409 In./yr.

Z = 64.849 In./yr.

We have found from the pool surveys that the composite rate integrated from the three erosion conditions results in from 2 to 3 inches per year.

"More information on the relative erodibility of the different soil conditions in the gullies will undoubtedly be brought out from splash studies at State College using artificial rainfall and through stability studies by the Slater method. In the meantime, it is recommended that the 2 inch per year figure be used over the Pontotoc Ridge Area.

"In a study of sediment transport for the Brown Loam streams the question has arisen as to the source of the sediment. Is it entirely from the gullied watershed or do the caving banks provide a considerable portion of the sediment load? The Flood Control folks have been anxious to make some bank studies along this line. We need to know the lateral movement of the bank per unit of time, that is, how many feet back per year? We need the average cross section of caved material and length of caved section to compute caved yardage. We then need information on the sand content of bank.

"Mr. Heard's office has requested us to develop a method that could be used in the field for determination of sand content of bank. This information is presented below:

"Whether the heavy sediment load of a stream originates largely from gullies in the watershed or from stream-bank caving is an important question in Flood Control Operations.

"Any determination of the contribution made by the banks to the sediment load will involve mechanical analysis of the bank material.

"It has been suggested that bank material could be placed in a graduate and shaken with water and the sand content read at once on the graduate. Our studies in the field and in the laboratory indicate that this method is wholly unreliable and cannot be recommended even for the roughest type of analysis.

"It has long been recognized by soil scientists that any type of mechanical analysis of soil even in the laboratory depends upon complete dispersion of the material. Obviously, if silt and clay aggregates are not dispersed, they behave in a suspension about the same as sand particles; that is, they fall rapidly in about the same time range as sand. Even if fairly complete dispersal could be effected in the graduate, then other technical difficulties in the field would prevent satisfactory readings of sand content. Reading time is very short, the order of 10 to 15 seconds, density of suspension must be determined, and accurate temperatures must be obtained.

"The following method for determination of sand content of bank material is suggested for field use by the engineering parties on Flood Control Operations:

1. A bank should be sampled at all necessary points in the profile from water level to top of bank in order to approximate fairly well the various strata of the bank. The word sand as used here means all material 100 mesh U. S. Std. (0.149 mm) and larger in diameter. 100 mesh represents the lower limit of particle size that has been found on the bed of most streams in sufficient amount for transport computation.
2. The sample consists of the contents of three cylinders of undisturbed material. These 'brass' cylinders are about 1.4 inches in diameter and are 2.11 inches long. Three such cylinders hold 166.67 cubic centimeters. The cylinders will be forced into the bank material by means of a heavy steel driving head tapped with a medium weight hammer. Four cylinders and one head have already been constructed at State College for each of the field parties. The three full cylinders may be removed by cutting around them with a chisel or screwdriver depending upon the hardness of the material. The surplus soil at each end of cylinder should be struck off with the back of a hacksaw blade or other straightedge.
3. Place the material from the three cylinders (called the sample) in a #2-1/2 tin can, add 20 cc of 1 normal sodium hydroxide solution and half fill can with water. Stir for 2 minutes with a thin wood paddle until there are no lumps or clods. Then stir vigorously for 2 minutes with an ordinary kitchen rotary type egg beater.
4. Pour stirred material over top of a 100 mesh U. S. Std. sieve and gently wash muddy water through until sand is clean and there is no more sand fine enough to be washed through. Use a small stream from an ordinary 8 quart sprinkling can. One sprinkling can of water is usually sufficient.
5. Transfer washed sand from 100 mesh sieve to a 200 cc. graduate by careful washing. Usually a flat pan somewhat like a pie pan and a small funnel will be needed in this transfer. (This is usually a vexing operation at best.)
6. Read volume of sand in graduate in cc. This volume multiplied by 0.6 is sand percentage by volume of the original sample.
7. Repeat for sample from each point desired in the profile.

Bill of Material

Estimated Cost

1 sprinkling can, 8 qt.	1.25
1 9" pie or cake pan	.50
1 200 cc graduate	1.50
1 100 mesh U. S. Std. Sieve - 8" diameter - brass	5.00
1 Medium size funnel	.25
1 Rotary egg beater for kitchen use	.75

4 cylinders and 1 driving head furnished without cost by Research project, MS-R-2, State College, Miss. The sodium hydroxide solution may also be furnished by Research.

"There may be times when determination of sand below 100 mesh in size is desirable. However, this is not recommended as a field operation due to difficulties of handling a nest of sieves and due to cost of sieves. Sieve cost increases rapidly above the 100 mesh. We like to use a 140 and a 270 in the laboratory; however, a 140 costs about \$15.00 while a 270 costs about \$26.00 and the finer opening sieves are very delicate.

"A quick source of supply for the 8-inch 100 mesh sieve, (U. S. Standard Series (.149 mm) opening) and for the 200 cc graduates is Fisher Scientific Company, 2109 Locust Street, St. Louis 3, Mo. The other items are available locally."

IRRIGATION AND WATER CONSERVATION DIVISION

Ventura County Investigation

Infiltration Tests - V. S. Aronovici and W. T. Gish, Moorpark, Calif. - "A ring infiltrometer study of a recently completed water spreading grounds in the Simi Valley Soil Conservation District is of special interest. The spreading grounds are located along old stream channel. This area was leveled and levees constructed around it. Heavy power equipment was used for this purpose. Ring infiltrometers, 1-foot in area were used to observe intake capacities of the grounds. Three rings were installed as follows: The first was driven into the ground 6 inches without disturbing the surface soil; the second was driven into the ground after the surface crust of approximately 1/2 inch was removed; the third unit was installed in the soil after the surface 3 inches were removed. All of these units were observed with an outer buffer pond. Tabulated below is a summary of the results:"

Elapsed	Ring 1 (surface)	Ring 2 (1/2 inch below surface)	Ring 3 (3 inches below surface)	Non-worked streambed 1/
Minutes	Ins./hr.	Ins./hr.	Ins./hr.	Ins./hr.
10	4.9	7.3	11.9	27.4
20	2.8	4.7	10.2	26.9
30	1.7	4.9	10.2	26.9
60	1.9	4.9	10.2	-

1/ Located downstream several miles from spreading grounds.

Consumptive Use Study - G. Marvin Litz and W. T. Gish, Los Angeles, Calif. - "In connection with the cooperative water-supply study in Calleguas and Simi Valley soil conservation districts (Zone 3) Ventura County, soil samples and volume-weight soil samples were taken at the bean and tomato plots. The consumptive use of water by the beans was computed from the seasons soil-moisture samplings.

Water Conservation Southern California Districts - H. F. Blaney, Los Angeles, Calif.

"During the past year the Division has been conducting water conservation and irrigation investigations in cooperation with several State soil conservation districts, and requests are pending for studies in the Upper Santa Clara and the San Jacinto Basin soil conservation districts. Recent dry years have demonstrated the limitations of local water supplies, the need for more efficient use of irrigation water and the necessity for importing a supplemental water supply. The combination

of deficient precipitation, declining ground-water supply, and limited sources of supplemental water supply has created critical water-supply problems in most of the soil conservation districts in Southern California. Also some cities which do not receive supplemental Colorado River water through the Metropolitan Water District are seriously affected by a water shortage. Precipitation records at San Diego, Los Angeles and Santa Barbara indicate that the last 10 years have been among the driest observed in Southern California. The greatest demand for ground water is during the periods of deficient precipitation and surface runoff. Thus an increasing demand on the ground water to satisfy current requirements has created an overdraft in some areas as well as permanent impairment in some coastal areas.

"During the last 2 years the Orange County Water District has purchased 53,000 acre-feet of this supplemental water from the Metropolitan Water District at a cost of \$745,000 for the purpose of recharging the depleted ground-water basin in the Coastal Plain. The Orange County Flood Control District is currently negotiating for an additional 25,000 acre-feet at a cost of \$250,000 to be used for the same purpose. A large portion of the San Jacinto Basin Soil Conservation District in Riverside County has joined the Metropolitan Water District and areas in two soil conservation districts in Ventura are considering the use of Colorado River water to supplement their declining ground-water supply. The U. S. Geological Survey reports that the combined supplemental water imported into southern California has steadily increased from 187,000 acre-feet in 1919-20 to 490,000 acre-feet in 1950-51. Even with this sizeable additional supply the current ground-water overdraft has not been alleviated."

Use of Water in Arizona - H. F. Blaney and K. Harris, Los Angeles and Phoenix

"A preliminary report on Consumptive Use and Irrigation Requirements of Crops in Arizona was completed. This report includes the results of research studies on use of water by various crops in Salt River Valley and tabulations of consumptive use and irrigation requirements in 25 areas of the State. An example of these data for average conditions in Maricopa County is shown in the following tables:"

Crop	Period	Consumptive	Estimated irrigation	
		use	Efficiency	Requirement
		Inches	Percent	Inches
Alfalfa	Oct. 11 to Nov. 20	47.8	.70	64
Cotton	April 1 to Oct. 31	31.2	.70	40
Grapefruit	Annual	45.6	.70	54
Oranges	Annual	36.5	.70	41
Melons	April 1 to July 31	22.6	.50	42
Flax	Nov. 1 to June 30	32.7	.70	40

Sprinkler and Surface Irrigation Studies - F. D. Griddle, Boise, Idaho

"Intake rates have been measured several times by concentric infiltrometer on "slick" spot and normal areas that have had gypsum applied to them. These measurements were made during the last part of the summer of 1950 and 1951. Results given below show definite increase in the intake rate with increased application of gypsum.

Treatment gypsum	Slick spot soils		Normal soils	
	Average final intake rate	Number times increase	Average final intake rate	Number times increase
<u>Tons/acre</u>	<u>Inches/hour</u>		<u>Inches/hour</u>	
0	0.025	--	0.16	--
10	.19	8	.40	2.5
20	.33	13	.44	2.8

"Also, some ring intake tests have been run on a slick spot area that was mixed to a depth of approximately 3 feet. This process mixed soil into a layer containing gypsum. Results from these tests also show an increase in intake with deep mixing."

Treatment	Mixed area	
	Average final intake rate	Number times increase
	<u>Inches/hour</u>	
Check	0.014	--
Mixed	.29	21

Consumptive Use - K. Harris and H. B. Peterson, Phoenix, Ariz.

"The consumptive use of water by irrigated cotton at Mesa, Ariz., as determined by soil samples is shown in the following report:"

Table 1.--Inches depth of water used by plants in intervals between irrigations or heavy rains

Date	Depth below surface						Total
	0-1'	1-2'	2-3'	3-4'	4-5'	5-6'	
May 8-May 30	0.82	0.69	0.33	0.32	0.00	0.00	
May 30-June 21	.90	.58	.52	.32	.27	.00	
June 21-July 11	1.46	.83	.72	.58	.27	.00	
July 11-19	.90	.36	.31	.22	.18	.13	
July 19-28	1.14	.89	.33	.32	.25	.13	
July 28-Aug. 24	1.99	2.03	1.41	.92	.64	.58	
Aug. 24-29	.38	.34	.29	.18	.12	.14	
Aug. 29-Sept. 30	1.81	1.81	1.36	1.00	.54	.58	
Sept. 30-31	.16	.34	.54	.54	.47	.27	
Total	9.56	7.87	5.81	4.40	2.74	1.83	32.2
% of total use	30	24	20	14	9	6	